In the Claims:

Claims 28-33, 35-53, 55-66 and 68 have been amended.

1-27. (cancelled)

28. (currently amended) An apparatus to provide image stabilization for a high-performance optical system ~~with lens elements in a housing with gas-filled spaces between the lens elements~~, the apparatus comprising:

lens elements in a housing with one or more gas-filled spaces between the lens elements; and

a heater arranged on an upper surface of the housing to provide a small thermal gradient with temperature ~~increases~~ changes in a vertical direction in the one or more gas-filled spaces between the lens elements ~~to create a stable thermal environment within the optical system~~.

29. (currently amended) An apparatus according to claim 28 further includes an insulation layer arranged over at least a portion of the housing and arranged to facilitate the temperature ~~change~~ changes of the gas present within the one or more gas filled spaces to create a stable thermal environment within the optical system.

30. (currently amended) An apparatus according to claim 28 further includes a gas manifold arranged adjacent a surface of the housing to flow gas around the housing surface to maintain a higher temperature on the upper surface of the housing than on the lower surface of the housing.

31. (currently amended) An apparatus according to claim 28 further includes a gas manifold to flow gas around the heater and located below the ~~optical~~ housing to prevent heating ~~[[the]]~~ a lower surface of the housing to a temperature

above the temperature on the upper surface of the housing.

32. (currently amended) An apparatus according to claim 28 further includes a control unit electrically connected to the heater to control the ~~operation thereof~~ **amount of heat generated by the heater**.

33. (currently amended) An apparatus according to claim 32 further includes an indicator light coupled to the ~~heater~~ **control unit** to indicate when the heater is activated.

34. (previously presented) An apparatus according to claim 28 wherein the heater supplies between about 1 and 50 Watts of power.

35. (currently amended) An apparatus according to claim 30 wherein the **[[~~air~~]] gas** manifold includes a hollow member with a plurality of apertures formed therein to provide distributed gas flow.

36. (currently amended) An apparatus according to claim 29 wherein the insulating layer includes a blanket of ~~Poron®~~ **flexible insulation**.

37. (currently amended) An apparatus according to claim 32 further includes an array of thermal sensors arranged over the housing in electrical communication with the control unit to ~~providing~~ **provide** temperature information of the housing to the control unit.

38. (currently amended) An apparatus according to claim 32 further includes an array of thermal sensors arranged over the housing and in communication with the one or more spaces, and in electrical communication with the control unit, to provide temperature information of the gas in the **one or more** gas-filled spaces to the control unit.

39. (currently amended) An apparatus according to claim [[28]] 29 wherein the insulating layer covers the heater.

40. (currently amended) An apparatus according to claim 28 wherein the gas in the one or more gas-filled spaces is air.

41. (currently amended) An apparatus to provide image stabilization for a high-performance optical system ~~with lens elements in a housing with gas-filled spaces between the lens elements~~, the apparatus comprising:

lens elements in a housing with one or more gas-filled spaces between the lens elements; and

a ~~cooling element arranged on~~ gas manifold adjacent a lower surface of the housing to flow gas to said housing to provide a small thermal gradient in the vertical direction in the one or more gas-filled spaces between the lens elements ~~to create a stable thermal environment within the optical system~~.

42. (currently amended) An apparatus according to claim 41 further includes an insulating layer arranged over at least a portion of the housing and arranged to facilitate the temperature ~~change~~ changes of the gas present within the one or more gas filled spaces to create a stable thermal environment within the optical system.

43. (currently amended) An apparatus according to claim 41 ~~further~~ includes a wherein said a gas manifold ~~arranged adjacent a surface of the~~ housing is positioned to flow gas around the housing surface to maintain a higher temperature on the upper surface of the housing than on the lower surface.

44. (currently amended) An apparatus according to claim 42 further includes heat generating elements and wherein said [[a]] gas manifold ~~to flow~~ flows gas ~~around the cooling element and located below the optical housing~~ over and around the heat generating elements to prevent heating [[the]] of a lower surface of the housing to a temperature above the temperature on the upper

surface of the housing.

45. (currently amended) An apparatus according to claim 41 further includes **a gas source coupled to said gas manifold and** a control unit electrically connected to the ~~**cooling element**~~ **gas source** to control the ~~**operation thereof**~~ **gas flow from the gas source**.

46. (currently amended) An apparatus according to claim 45 further includes an indicator light coupled to the ~~**cooling element**~~ **control unit** to indicate when the ~~**cooling element**~~ **gas source** is activated.

47. (currently amended) An apparatus according to claim 44 wherein the **[[~~air~~]] gas** manifold includes a hollow member with a plurality of apertures formed therein to provide distributed gas flow.

48. (currently amended) An apparatus according to claim **[[~~43~~]] 42** wherein the insulating layer includes a blanket of ~~**Poron®**~~ **flexible insulation**.

49. (currently amended) An apparatus according to claim **[[~~46~~]] 45** further includes an array of thermal sensors arranged over the housing in electrical communication with the control unit to providing temperature information of the housing to the control unit.

50. (currently amended) An apparatus according to claim **[[~~46~~]] 45** further includes an array of thermal sensors arranged over the housing and in communication with the one or more **gas filled** spaces, and in electrical communication with the control unit, to provide temperature information of the gas in the **one or more** gas-filled spaces to the control unit.

51. (currently amended) An apparatus according to claim 42**:**

further includes a heater arranged on an upper surface of the housing to provide a small thermal gradient with temperature increases in a vertical

direction in the one or more gas-filled spaces between the lens elements;
and wherein the insulating layer covers the heater.

52. (currently amended) An apparatus according to claim 41 wherein the gas in the **one or more** gas-filled spaces is air.

53. (currently amended) A lithography system to pattern a wafer with an image of a mask, comprising:

an illumination system to irradiate the mask;

a microlithographic lens with one or more lens elements, and a housing to house the lens elements and to define **one or more** gas-filled spaces between the lens elements;

a heater arranged on an upper surface of the housing to provide a small thermal gradient with temperature increases in **[[the]] a** vertical direction in **the** one or more gas-filled spaces between lens elements ; and

a wafer stage to support the wafer to be exposed with the image.

54. (previously presented) A system according to claim 53 further includes an insulation layer arranged over at least a portion of the housing and arranged to facilitate the temperature change of gas present within the one or more spaces to create a stable thermal environment within the one or more spaces.

55. (currently amended) A system according to claim 53 wherein the gas in the **one or more** gas-filled **~~space~~ spaces** is air.

56. (currently amended) An system according to claim 53 **~~wherein the heater~~ further** includes a gas manifold arranged adjacent a surface of the housing to flow a gas around the surface to maintain a higher temperature on the upper surface of the housing **than on a lower surface**.

57. (currently amended) An system according to claim 53 further includes a gas manifold **~~to flow gas around the heater and~~** located below the

optical housing to flow gas around the housing and to prevent heating [[the]] a lower surface of the housing to a temperature above the temperature on the upper surface of the housing.

58. (currently amended) An system according to claim 53 further includes a control unit electrically connected to the heater to control the operation thereof the amount of heat generated by the heater.

59. (currently amended) A lithography system to pattern a wafer with an image of a mask, comprising:

an illumination system to irradiate the mask;

a microlithographic lens with one or more lens elements, and a housing to house the lens elements and to define one or more gas-filled spaces between the lens elements;

a cooling element arranged on gas manifold adjacent a lower surface of the housing flows gas around said housing to provide a small thermal gradient in [[the]] a vertical direction in the one or more gas-filled spaces between lens elements; and

a wafer stage to support the wafer to be exposed with the image.

60. (currently amended) A system according to claim 59 further includes an insulation layer arranged over at least a portion of the housing and arranged to facilitate the temperature change of gas present within the one or more spaces to create a stable thermal environment within the one or gas filled more spaces.

61. (currently amended) A system according to claim 59 wherein the gas in the one or more gas-filled space spaces is air.

62. (currently amended) An apparatus according to claim 59 further includes a wherein said gas manifold arranged adjacent a surface of the housing is positioned to flow a gas around the housing surface to maintain a higher temperature on [[the]] an upper surface of the housing than on a lower surface of

the housing.

63. (currently amended) An apparatus according to claim 59 further includes heat generating elements and wherein said [[a]] gas manifold to flow flows gas around the cooling element and located below the optical housing over and around the heat generating elements to prevent heating the lower surface of the housing to a temperature above the temperature on [[the]] an upper surface of the housing.

64. (currently amended)) An apparatus according to claims 59 further includes a gas source coupled to said gas manifold and a control unit electrically connected to the cooling element gas source to control the operation thereof gas flow from the gas source.

65. (currently amended) A method for stabilizing the imaging of a high-performance optical system subject to thermal instability, comprising the step of:

heating a top portion of an optical system or cooling [[the]] a bottom portion of the optical system so that gas in having one or more gas-filled spaces of the optical system so that gas in the one or more gas-filled spaces has a temperature gradient that increases the temperature from the bottom to the top of the optical system within the one or more gas-filled spaces to form a stable thermal environment within the gas-filled spaces.

66. (currently amended) A method according to claim 65, further including the step of flowing gas over and around one or more heat-generating elements to prevent heat from the one or more heat-generating elements from heating the lower surface bottom portion of the optical system to a temperature above the temperature on the upper top portion of the optical system.

67. (previously presented) A method according to claim 65, further including the step of detecting image instability in the optical system.

68. (currently amended) A method according to claim **[[65]]** **67** wherein the step of detecting image stability includes the step of measuring the temperature gradient across the **one or more** gas filled spaces of the optical system.

69. (previously presented) A method according to claim 67, wherein the step of detecting imaging instability includes the step of measuring locations of images from the optical system at different times.

70. (previously presented) A method according to claim 69, further including the step of measuring overlay errors between first and second level exposure fields.

71. (previously presented) A method according to claim 69, further including the step of using an image position monitor to measure changes in the image locations.

73. (previously presented) A method according to claim 65, wherein the heating or cooling is carried out without significantly changing magnification of the optical system.